BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images may include (but are not limited to):

- BLACK BORDERS
- TEXT CUT OFF AT TOP, BOTTOM OR SIDES
- FADED TEXT
- ILLEGIBLE TEXT
- SKEWED/SLANTED IMAGES
- COLORED PHOTOS
- BLACK OR VERY BLACK AND WHITE DARK PHOTOS
- GRAY SCALE DOCUMENTS

IMAGES ARE BEST AVAILABLE COPY.

As rescanning documents *will not* correct images, please do not report the images to the Image Problem Mailbox.

Intramedullary intertrochanteric fracture fixation appliance and fitting device.

Patent Number: EP0321170, B1

Publication date: 1989-06-21

Inventor(s): LAWES PETER (GB); TAYLOR STEPHEN (GB); ADCOCK PHILIP JOHN (GB)

Applicant(s):: HOWMEDICA (IE)

Requested Patent: JP10066698

Application Number: EP19880311746 19881212

Priority Number (s): GB19870029146 19871214; GB19880014920 19880623

IPC Classification: A61B17/58

EC Classification: A61B17/74D, A61B17/92B

Equivalents: AU2683488, AU628747, AU7827291, CA1323536, DE3852282D, DE3852282T, DE3855014D, DE3855014T, DE8815516U, ES2064363T, ES2083675T, IE65776, JP2021859, JP2599777B2, JP2735536B2, JP2766258B2, JP9164151, US5176681

Abstract

An intramedullary intertrochanteric fracture fixation appliance comprising an intramedullary rod having an angulated opening to receive a femoral neck screw, said rod having a co-axial bore extending into said angulated opening, anti-rotation means located in said bore to selectively prevent rotation of said neck screw in the rod and the open end of said bore being provided with means to positively locate a removable fitting device on the proximal end of the rod and so that said anti-rotation means can be operated with the fitting device in position.

(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 321 170 B1**

(12) EUROPEAN PATENT SPECIFICATION

(45) Date of publication of patent specification: **30.11.94** (51) Int. Cl.5: **A61B 17/58**

(21) Application number: **88311746.7**

(22) Date of filing: **12.12.88**

The file contains technical information submitted after the application was filed and not included in this specification

(54) Intramedullary intertrochanteric fracture fixation appliance and fitting device.

(30) Priority: **14.12.87 GB 8729146**
23.06.88 GB 8814920

(43) Date of publication of application:
21.06.89 Bulletin 89/25

(45) Publication of the grant of the patent:
30.11.94 Bulletin 94/48

(84) Designated Contracting States:
AT BE CH DE ES FR GB GR IT LI LU NL SE

(56) References cited:
EP-A- 0 187 283
DE-U- 8 528 770
DE-U- 8 620 399
US-A- 4 622 959

Surgical Techniques, Zickel II by Howmedica ST 3215-1, 6/85

Surgical Techniques , Zickel II by Howmedica ST 3215-1, 6/85

(73) Proprietor: **HOWMEDICA INTERNATIONAL INC.**
Shannon Industrial Estate
Shannon Co. Clare (IE)

(72) Inventor: **Lawes, Peter**
"Kingsmede"
18 Laburnham Road
Maidenhead Berkshire (GB)
Inventor: **Taylor, Stephen**
"Roxana"
Glebe Road
Ramsden-Bellhouse
Basildon Essex (GB)
Inventor: **Adcock, Philip John**
98 Conway Avenue
Great Wakering Essex (GB)

(74) Representative: **Bridge-Butler, Alan James et al**
G.F. Redfern & Co.
Redfern House
149/151 Tarring Road
Worthing, West Sussex BN11 4HE (GB)

EP 0 321 170 B1

Description

This invention relates to an intramedullary intertrochanteric fracture fixation appliance and a removable fitting device for use with it.

Intramedullary intertrochanteric fracture fixation devices are known, for example as shown in DE U 8 620 399, which comprises an intramedullary rod having an angulated opening to receive a femoral neck screw, which is sometimes provided in the form of a lag screw. The intramedullary rod is fitting in the intramedullary canal of the femur and the neck screw passes through an opening in the intramedullary rod, through the neck of the femur and into the head. With this kind of device it is possible to produce tension in the neck screw to pull the head and neck of the femur together and means can be provided to prevent the screw rotating both during this operation and in its final position. This can be provided by the provision of grooves in the neck screw into which a set screw can be located thus allowing the neck screw to slide but not rotate and when the procedure has been completed the set screw can be tightened up to hold the parts in a fixed position. Alternatively, some surgeons prefer to leave the set screw loose merely preventing rotation as required for the particular patient.

It is also known to provide a fitting device to assist in locating the various parts during the operation. Thus, the fitting device may be arranged to clamp to the upper end of the intramedullary rod of the kind shown in DE U 86 20 399 and to provide a guide to enable a hole to be bored in the head of the femur to accept the neck screw. The guide can also remain in position to assist in guiding the compression screw whilst it is being screwed into position. Such fitting devices can also provide guides for drilling holes further down the femur to allow location screws to be passed through the lower end of the intramedullary rod to locate it.

A disadvantage with the arrangement set forth above is that the fitting device has to be removed to allow the set screw, or other means to hold the neck screw in position, to be operated and there is a tendency for the neck screw to unwind or move longitudinally in the intramedullary rod whilst the fitting device is being removed and before the set screw can be inserted, and an object of the present invention is to provide such an intramedullary intertrochanteric fracture fixation appliance which has provision for carrying out the operation of locking the neck screw and avoiding its becoming loosened or moving during operation.

According to the present invention an intramedullary intertrochanteric fracture fixation appliance for use with a removable fitting device and which comprises an intramedullary rod having proximal and distal ends and having an angulated opening to receive a femoral neck screw, said rod having a co-axial bore extending into said angulated opening, anti-rotation means located in said co-axial bore which can be actuated to prevent rotation of said neck screw in said angulated opening and the proximal end of said co-axial bore being provided with attachment means to receive said removable fitting device characterised in that said attachment means are independent and separate from said anti-rotation means and can be operated to receive, positively hold and locate said removable fitting device independently of the actuation of said anti-rotation means.

Thus, any operation of the anti-rotation means can take place with the fitting device still in position and the risk of the neck screw loosening is reduced.

There are also other advantages in as much that a guide means for guiding means for drilling the hole in the head and neck of the femur can also be left in position whilst the anti-rotation means are fitted.

A further advantage is that the complete operation can be carried out and completed before removal of the fitting appliance and so that the operative steps are not divided up.

Preferably said attachment means are provided by an enlarged threaded portion of said co-axial bore. Said anti-rotation means can include longitudinally extending grooves provided on said neck screw which can be engaged by a set screw located in said bore to prevent rotation of the neck screw while permitting sliding movement thereof or clamp it in position.

The invention also includes an intramedullary intertrochanteric fracture fixation appliance as set forth above in combination with a removable fitting device therefor, which has location means for positively locating said device on the proximal end of said rod by engaging said attachment means characterised by said location means having access means for operation of said anti-rotation means with the fitting device positively located on said rod.

The access means can be provided by access opening means through which said anti-rotation means can be operated when the fitting device is in position on the rod.

Preferably the location means include a securing bolt which engages a threaded portion of the co-axial bore to clamp the fitting device in position on said rod, said securing bolt having access opening means in the form of a bore through which the anti-rotation means in the co-axial bore in the rod can be operated.

The access opening means can be dimensioned to allow the set screw to be inserted there-

through into the co-axial bore.

The guide means preferably includes a tunnel locator and one end of the tunnel locator can be adapted to engage the intramedullary rod.

The fitting device may also include a removable tension adjuster which extends through the tunnel locator for connection to the proximal end of the neck screw and has adjustment means for applying a tension to said screw.

The adjustment means can be arranged to engage the proximal end of the tunnel locator to apply a compression thereof between said adjustment means and the intramedullary rod.

Preferably the removable tension adjuster has means to engage driving means on the neck screw to drive it into position.

The removable tension adjuster can therefore comprise a screw driver with a hollow shaft, the distal end of said shaft having means to engage the neck screw to drive it into position and an operating handle, a tensioning adjuster extending axially through said hollow shaft, one end of said adjuster being screw threaded to engage a threaded bore on the end of the neck screw and the other end having an operating portion by which it can be rotated, the hollow shaft carrying a screw threaded adjuster which can act against the proximal end of the tunnel locator.

The removable fitting device can also be provided with means for guiding means for forming a hole or holes in the femur to receive screws or pins to locate the distal end of the intramedullary rod.

Two sizes of set screw can be provided for use in the intramedullary rod, one screw being of a substantially plain configuration and the other having a flange which can engage abutment means on the intramedullary rod to locate its axial position so that it can enter the grooves in the neck screw but not lock it in position.

The invention can be performed in many ways and two embodiments will now be described by way of example and with reference to the accompanying drawings in which :

Figure 1 is a diagrammatic part cross-sectional view of the fracture fixation appliance and fitting device according to the invention;

Figure 2 is a part cross-sectional side elevation of the device and appliance shown in Figure 1 showing the various parts ready for assembly;

Figure 3 is an enlarged cross-sectional view of part of the fixation appliance and fitting device shown in Figures 1 and 2.

Figure 4 is a part sectional cross-sectional side view of an alternative form of fracture fixation appliance; and,

Figure 5 is a cross-sectional view of the neck screw on the line IV-IV of Figure 4.

As shown in Figures 1, 2 and 3 of the drawings the intramedullary intertrochanteric fracture fixation appliance comprises an intramedullary rod 1 for introduction into the intramedullary canal of a femur. As is most clearly shown in Figure 3 the intramedullary rod has an angulated opening 2 and a co-axial bore 3 which opens into the angulated opening 2 and in which is located anti-rotation means in the form of a set screw 4.

Located in the angulated opening 2 is a femoral neck screw 5 in the form of a lag screw, one end of which carries a coarse screw thread 6 and which is provided with four longitudinally extending grooves 7. The lower end of the set screw 4 is provided with a location boss 8 which is dimensioned so that it can engage one of the grooves 7 and thus prevent rotation of the neck screw 5 when the set screw is in the position shown in Figures 1 and 3. In order to receive set screw 4 the bore 3 is screw threaded at 9 and the upper end of the bore indicated by reference numeral 10 is of enlarged diameter and is also screw threaded at 11. The proximal end of the intramedullary rod is provided with two radially extending slots 12 to receive and locate a fitting device indicated by reference numeral 13 and the distal end of the rod is provided with two holes 14 and 15 to receive pins or screws to fix and locate that end of the rod in the bone.

The proximal end of the neck screw 5 is provided with driving means in the form of circumferentially opposed slots 20 and is formed with a bore 21 which is screw threaded at 22 to receive a removable tension adjuster to be described hereunder.

The fiting device 13 comprises an angulated arm 25 one end of which carries a boss 26 the lower end of which is provided with pegs 27, as is most clearly shown in Figure 2, and which are shaped to engage in the slots 12 in the proximal end of the intramedullary rod 1. A securing bolt 28 is provided the shank 29 of which is a close sliding fit in a bore 30 in the boss 26. The securing bolt 28 has a stepped bore 31 the upper enlarged end of which is screw threaded at 32. The lower end of the shank 29 also carries an external screw thread 33 which is adapted to engage with the screw thread 11 in the bore 10 of the rod 1 so that the boss 26 can be firmly clamped to the upper end of the intramedullary rod 1 and held against rotation by the pegs 27.

The other end of the angulated arm 25 carries a guide block 35 which is provided with an angulated bore 36 and two further alignment bores 37 and 38. The positioning of the bore 36 is arranged so that when the fitting device is clamped in position on the rod 1 the bore 36 is accurately aligned with the angulated hole 2 in the rod 1. Similarly the bores 37 and 38 are aligned with the holes 14 and

15 in the rod 1.

Also provided are three tunnel locators. The locator for the angled bore 36 comprises a tubular portion 40 one end of which carries a flange 41 and the other end of which is shaped as shown at 42 to engage the circumferential shape of the rod 1 in close alignment and so that it is held against rotation. The other tunnel locators 45 and 46 also consist of tubes 47 with flanged ends 48. As will be seen from Figure 1 the tunnel locators can be positioned in the bores 36, 37 and 38 in the guide block 35 and are removable slide fits therein. The length of the locators is arranged so that they can extend from the guide block 35 up to and in engagement with the intramedullary rod 1.

A removable tension adjuster is provided which can extend through the tunnel locator 40 for connection to the proximal end of the neck screw 5 and adjustment means are provided for applying a tension to the screw when it is in position in the bone in order to enable the fractured portion to be pulled into close proximity with the remainder of the bone. The tension adjuster comprises a hollow screw driver 50 which has a hollow handle 51, a hollow shank 52 and a substantially cruciform shaped end 53 which can engage in the slots 20 in the end of the compression screw so that the screw 5 can be turned. The outer circumference of the shank 52 is screw threaded at 54 and carries a hand wheel 55. Extending axially through the screw driver 50 is a tensioning adjuster in the form of a tubular rod 56 one end of which is screw threaded at 57 and the other end of which is provided with a boss 58 by which the rod may be rotated. The rod is free to slide axially within the screw driver 50 and a portion of the rod is provided with an upstanding screw thread 59 which can be screwed through a co-operating screw thread 60 provided in a bore in the distal end of the handle 51. The length of the rod 56 is arranged so that the screw thread 57 can protrude from the end of the shank 52 with the boss 58 located against the end of the handle. Four arrows 61 are marked on the diametrically opposed sides of the handle 51 for reasons to be described hereunder. The shank 52 is an accurate sliding fit in the bore of the tunnel locator 40.

The thread 59 of the rod 56 prevents the rod falling out of the screw driver but when it is desired to remove the rod for sterilization purposes it is merely necessary to withdraw it until the screw thread 59 engages the screw thread 60 and then rotate it until the rod is free.

A further screw driver 70 is also provided and which has a suitably shaped end to engage a socket 71 provided in the end of the set screw 4.

A location rod (not shown) is also provided in the form of a simple length of circular rod of the same diameter as the neck screw 5, one end of the rod being bent over to form an arm. The use of this rod will be described later.

When the operation is to be carried out the intramedullary rod 1 is located in the intramedullary canal of the femur in the usual way and the fitting device 13 is placed in position by engaging the pegs 27 in the slots 12 and inserting the securing bolt 28, the thread on the bolt engaging the thread in the upper end of the bore in the rod and thus clamping the fitting device against rotation or rocking movement. The tunnel locator is now placed in position in the bore 36 and a hole is bored through the femur, the neck of the femur and into the head thereof to receive the femoral neck screw 5. The tunnel locator therefore acts as a guide. During this part of the operation the fractured neck or head of the femur can be displaced and it is necessary to draw it into engagement with the remainder of the bone. In order to achieve this the set screw 4 is inserted down the bore of the bolt 28 so that its screw thread 9 engages the screw thread in the lower end of the bore 3. The length of rod (not shown) previously referred to is now inserted into the tunnel locator so that it extends into the opening 2 and the set screw 4 is advanced until it touches the rod. The surgeon now knows that the end of the set screw is approximately in line with the surface of the opening 2. The neck screw is now screwed into position by operating the screw driver 50, its cruciform end engaging the slots 20 in the end of the screw, and the arrows 61 on the screwdriver are used to align one of the grooves 7 in the uppermost position. The set screw is now turned downwards with the screwdriver 70 until the lower end of the set screw is engaged within one of the grooves 7. Provided the screw is not tightened the neck screw now has the facility to slide in the opening 2 but is locked against rotation. With the neck screw 5 in this position the inner rod 56 of the screwdriver is now rotated by operating the knob 58 and so that the screw thread 57 at its distal end engages the screw thread 21 in the proximal end of the neck screw 5. With the inner rod 56 now held in position on the screw the hand wheel 55 is rotated so that it engages and acts against the flange 41 of the tunnel locator 40. As the other end of the locator engages against the rod 1 further movement of the hand wheel 55 will cause the whole screwdriver to be drawn outwardly taking with it the neck screw 5. As the neck screw is held against rotation by the set screw 4 it merely slides through the opening 2 and draws the head of the femur into close engagement with the rest of the bone. In certain circumstances it is not necessary to maintain the tension in the neck screw and it can be relaxed, the operation of drawing the bones together having been completed. Alternatively, it

may be necessary to hold the bones together under tension and in order to achieve this the set screw 4 is now tightened down further so that it firmly holds the neck screw in position.

The screw driver can now be removed.

Before or after the previous operations the tunnel locators 45 and 46 can be used to accurately drill through the bone so that pins and/or screws can be inserted down them to locate the distal end of the rod 1.

The tunnel locators can also be used for controlling the position and angulation of guide wires, the drills, the taps and, as referred to above, the femoral neck screw or other screws.

Thanks to the construction of the securing bolt 28 it is possible to achieve all the necessary actions without removing the fitting device and thus it is not necessary to remove the tunnel locator before fully and finally fitting the implant. This has various advantages, firstly the femoral neck screw can be fully fitted and locked before moving on to fit the optional distal screws in the holes 14 and 15. There is always a risk that while the two distal locking screws are being fitted or while the tunnel locator is being removed the neck screw can rotate (with or without the femoral head also rotating) and this can prevent the set screw from correctly engaging the neck compression screw groove.

There are also advantages in completing the implantation and then removing the instrument rather than dividing up the operative steps.

The operating surgeon is given a number of choices; he can either tightly lock the assembly (so that neither sliding nor rotation of the neck screw can occur), or he can fit the set screw so that it allows sliding and prevents rotation.

As there will be a family of sizes of both intramedullary rods and neck screws it is difficult to standardise the distance from the upper end of the intramedullary rod to the neck screw and this poses a constraint on the standardisation of set screws.

It is impractical to provide for the surgeon to check the correct position of the locking screw by direct observation (visually or X-ray) or by feeling the top of said screw relative to the top end of the intramedullary rod. In order to do this it would inevitably be necessary to produce a family of set screws. Any error made in the operating theatre (wrong choice of screw size) or made by the manufacturer (screw too short, too long) or incorrectly identified, would render the design non-foolproof.

A further feature of the present invention therefore is that it is possible to have one size of set screw only and which is fitted to the intramedullary rod 1 before the femoral neck screw is installed in the manner described above.

To recap this procedure therefore, firstly a rod corresponding to the diameter of the neck screw 5 is passed through the lateral femoral cortex (after reaming using the tunnel locator) and juts through the intramedullary rod. The set screw is now driven in until it jams against the rod. This position is determined when the rod will no longer freely rotate and it is for this reason that the end of the rod is provided with an arm. The set screw is now backed off approximately one turn to release the rod, the rod is removed, the appropriate femoral neck screw is connected and inserted in the manner described above and with one of the grooves 7 directly beneath the set screw. The set screw is now driven in more than one turn (depending on the choice of screw pitch) and it is then definitely engaging in the neck screw groove.

As described above, if desired the surgeon can drive the set screw a further turn to cause it to firmly jam in the groove 7 thereby locking the total assembly and preventing sliding.

If desired this type of set screw can have a Nylok pellet in the thread to prevent involuntary rotations when in service.

Although the above method of operation is practical and simple it does have the disadvantage that the surgeon must remember that after jamming the test rod with the set screw that he backed off one turn (say) then after installing the neck screw that he must drive the screw in two turns (say) to allow sliding of the lag screw.

As an alternative a shoulder can be provided in the bore inside each size of intramedullary rod at a fixed height above the opening 2. This shoulder engages with a corresponding shoulder on a set screw of the type shown in Figure 2 where the shoulder is indicated by reference numeral 73. This shoulder is arranged at a suitable distance from the end 8 of the set screw so that when it engages the shoulder in the rod 1 the end of the screw protrudes into the opening 2 and, provided it is in a groove 7, has sufficient effect to prevent rotation of the neck screw but does not act to lock it in position against sliding. Thus, after installing the neck screw the set screw is merely driven down to the shoulder.

The remainder of the steps of the operation will be as set forth above to avoid the risk of a bone chip fouling said screw thread and causing the surgeon to believe mistakenly that the set screw was fully home.

With a set screw of this type however it will be appreciated that there is no provision for totally locking the assembly against sliding although it will lock it against rotation.

To overcome this difficulty a second set screw is provided which does not have a shoulder and which is slightly longer than the first set screw

referred to above so that when it is screwed in to its full extent it locks in the groove 7 and not only prevents rotation but also prevents sliding. As the shoulder is not required on this second screw it is possible to design it to be visually different from the first, that is there is no shoulder, thereby reducing the risk of error by the manufacturer, surgeon or nurse in incorrectly identifying the required screw. If desired the screw with a shoulder can be simply labled "sliding" whilst the slightly longer screw without the shoulder can simply be labled "locking". A screw without a shoulder is shown in Figure 1 and a screw with a shoulder in Figures 2 and 3.

Figures 4 and 5 show an alternative construction of fixation appliance but the same reference numerals are used to indicate similar parts to those shown in Figures 1, 2 and 3. In this construction the femoral neck screw 5 in the form of a lag screw is provided with four longitudinally extending ramp shaped grooves 77. As will be seen from the drawing the shallow ends 78 of the ramps, that is the deeper ends of the grooves 77 are towards the threaded end of the neck screw.

As will be seen the set screw 4 now acts not only as anti-rotation means but as an adjustable stop for limiting the length of sliding movement of the lag screw in relation to the rod. Thus, movement towards the left hand side of the drawing, that is in the direction of the screw threaded portion of the rod, by the screw is restricted by the set screw engaging the rising ramp in the slot 77 but, because the slot is angled away from the set screw, in the other direction, there is relative sliding movement between the parts in that direction.

The surgeon now has three choices, when the fractured femur has been drawn together the surgeon can screw down the set screw to cause it to firmly jam in the groove 77 thereby locking the total assembly and preventing sliding. Alternatively, the surgeon may merely allow the screw to lightly engage in the groove 77 thus allowing relative sliding movement between the parts but preventing turning. The third alternative is to screw the set screw 4 down until it engages the ramp, for example as shown in Figure 3 of the drawings. In this position relative movement between the parts is allowed when compression is applied to the bone fracture. This compression is therefore maintained when the fitting device 13 referred to above is removed. The neck screw is still free to move when body weight or muscle activity takes effect on the hip joint but the set screw 4 limits the relative movement over a selected portion of the length of the neck screw.

Claims

1. An intramedullary intertrochanteric fracture fixation appliance for use with a removable fitting device (13) and which comprises an intramedullary rod (1) having proximal and distal ends and having an angulated opening (2) to receive a femoral neck screw (5), said rod (1) having a co-axial bore (3,10) extending into said angulated opening (2), anti-rotation means (4,7) located in said co-axial bore (3,10) which can be actuated to prevent rotation of said neck screw (5) in said angulated opening (2) and the proximal end of said co-axial bore (3,10) being provided with attachment means (11) to receive said removable fitting device (13) characterised in that said attachment means (11) are independent and separate from said anti-rotation means (4,7) and can be operated to receive, positively hold and locate said removable fitting device (13) independently of the actuation of said anti-rotation means (4,7).

2. An intramedullary intertrochanteric fracture fixation appliance as claimed in claim 1 characterised in that said attachment means (11) are provided by an enlarged threaded portion (11) of said co-axial bore (10).

3. An intramedullary intertrochanteric fracture fixation appliance as claimed in claim 1 and claim 2 in which said anti-rotation means (4,7) includes longitudinally extending grooves (7) provided on said neck screw (5) which can be engaged by a set screw (4) located in said bore (3,10) to prevent rotation of the neck screw (5) while permitting sliding movement thereof or clamp it in position.

4. An intramedullary intertrochanteric fracture fixation appliance as claimed in claim 3 characterised by including two of said set screws (4) but of different sizes for alternative use in the intramedullary rod (1), one screw (4) being of a substantially plain configuration and the other having a flange (73) which can engage abutment means on the intramedullary rod (1) to locate its axial position so that it can enter the grooves (7) in the neck screw (5) but not lock it in position.

5. An intramedullary intertrochanteric fracture fixation appliance as claimed in any one of preceding claims 1 to 4 in combination with a removable fitting device (13) therefore, which has location means (12,27,28) for positively locating said device (13) on the proximal end

of said rod (1) by engaging said attachment means (11) characterised by said location means (12,27,28) having access means (31) for operation of said anti-rotation means (4,7) with the fitting device (13) positively located on said rod (1).

6. An intramedullary intertrochanteric fracture fixation appliance and fitting device as claimed in claim 5 characterised in that said access means (31) are provided by access opening means (31) through which said anti-rotation means (4,7) can be operated when the fitting device (13) is in position on the rod (1).

7. An intramedullary intertrochanteric fracture fixation appliance and fitting device as claimed in claim 6 characterised in that said location means (12,27,28) includes a securing bolt (28) which engages a threaded portion (11) of the co-axial bore (3,10) to clamp the fitting device (13) in position on said rod (1), said securing bolt (28) having access opening means (31) in the form of a bore (31) through which the anti-rotation means (4,7) in the co-axial bore (3,10) in the rod (1) can be operated.

8. An intramedullary intertrochanteric fracture fixation appliance and fitting device as claimed in claim 6 or claim 7 characterised in that said anti-rotation means (4,7) include a set screw (4) and the access opening means (31) are dimensioned to allow the set screw (4) to be inserted therethrough into the co-axial bore (3).

9. An intramedullary intertrochanteric fracture fixation appliance and fitting device as claimed in any one of the preceding claims 5 to 8 characterised by guide means (36,40) for accurately guiding means for forming a hole in the femoral end head to receive said femoral neck screw (5).

10. An intramedullary intertrochanteric fracture fixation appliance and fitting device as claimed in claim 9 characterised in that said guide means (36,40) include a tunnel locator (40).

11. An intramedullary intertrochanteric fracture fixation appliance and fitting device as claimed in claim 10 characterised in that one end (42) of said tunnel locator (40) is adapted to engage and locate on the intramedullary rod (1).

12. An intramedullary intertrochanteric fracture fixation appliance and fitting device as claimed in claim 10 or claim 11 characterised in that said fitting device includes a removable tension adjuster (50) which extends through said tunnel locator (40) for connection to the proximal end of the neck screw (5) and has adjustment means (56) for applying a tension to said screw (5).

13. An intramedullary intertrochanteric fracture fixation appliance and fitting device as claimed in claim 12 characterised in that said adjustment means (55,56) engage the proximal end of the tunnel locator (40) to apply a compression thereon between said adjustment means (55,56) and the intramedullary rod (1).

14. An intramedullary intertrochanteric fracture fixation appliance and fitting device as claimed in claim 13 characterised in that said removable tension adjuster (50) has means (53) to engage driving means (20) on the neck screw (5) to drive it into position.

15. An intramedullary intertrochanteric fracture fixation appliance and fitting device as claimed in claim 14 characterised in that said removable tension adjuster (50) comprises a screw driver with a hollow shaft (52), the distal end of said shaft (52) having means (53) to engage the neck screw (5) to drive it into position and an operating handle (51), a tensioning adjuster (56) extending axially through said hollow shaft (52), an end of said adjuster being screw threaded (57) to engage a threaded bore (21) in the end of the neck screw (5) and the other end having an operating portion (51) by which it can be rotated, the hollow shaft (52) carrying a screw threaded adjuster (55) which can act against the proximal end of the tunnel locator (41).

16. An intramedullary intertrochanteric fracture fixation appliance and fitting device as claimed in any one of the preceding claims 5 to 15 in which said removable fitting device is provided with means (45,46) for guiding means for forming a hole or holes in the femur to receive screws or pins to locate the distal end of the intramedullary rod (1).

Patentansprüche

1. Intramedulläre intertrochantäre Frakturfixationsvorrichtung zur Verwendung mit einer abnehmbaren Einpaßvorrichtung (13) und umfassend einen intramedullären Stab (1) mit einem proximalen und distalen Ende und mit einer angewinkelten Öffnung (2) zur Aufnahme einer Schenkelhalsschraube (5), wobei der besagte Stab (1) eine sich in die besagte angewinkelte

Öffnung (2) erstreckende koaxiale Bohrung (3,10) aufweist, eine in der besagten koaxialen Bohrung (3,10) angeordnete Anti-Dreheinrichtung (4,7), die betätigt werden kann, um eine Drehung der besagten Halsschraube (5) in der besagten angewinkelten Öffnung (2) zu verhindern, und wobei das proximale Ende der besagten koaxialen Bohrung (3,10) mit Befestigungseinrichtungen (11) zur Aufnahme der besagten abnehmbaren Einpaßvorrichtung (13) versehen ist, dadurch gekennzeichnet, daß die besagten Befestigungseinrichtungen (11) unabhängig und getrennt von der besagten Anti-Dreheinrichtung (4,7) sind und betätigt werden können, um die besagte abnehmbare Einpaßvorrichtung (13) unabhängig von der Betätigung der besagten Anti-Dreheinrichtung (4,7) aufzunehmen, bestimmt zu halten und zu fixieren.

2. Intramedulläre intertrochantäre Frakturfixationsvorrichtung nach Anspruch 1, dadurch gekennzeichnet, daß die besagten Befestigungseinrichtungen (11) durch einen erweiterten, mit einem Gewinde versehenen Teil (11) der besagten koaxialen Bohrung bereitgestellt werden.

3. Intramedulläre intertrochantäre Frakturfixationsvorrichtung nach Anspruch 1 und Anspruch 2, bei der die besagte Anti-Dreheinrichtung (4,7) auf der besagten Halsschraube (5) vorgesehene, in Längsrichtung verlaufende Nuten (7) umfaßt, mit denen eine in der besagten Bohrung (3,10) angeordnete Stellschraube (4) in Eingriff treten kann, um eine Drehung der Halsschraube (5) zu verhindern, während sie eine Verschiebebewegung derselben zuläßt, oder um sie in ihrer Lage festzuklemmen.

4. Intramedulläre intertrochantäre Frakturfixationsvorrichtung nach Anspruch 3, dadurch gekennzeichnet, daß sie zwei der besagten Stellschrauben (4), jedoch von unterschiedlicher Größe, für eine alternative Verwendung im intramedullären Stab (1) einschließt, wobei eine Schraube (4) von einer im wesentlichen glatten Gestalt ist, und die andere einen Flansch (73) aufweist, der mit einer Anschlageinrichtung am intramedullären Stab (1) in Eingriff treten kann, um ihre axiale Position so fixieren, daß sie in die Nuten (7) in der Halsschraube (5) eintreten kann, dieselbe jedoch nicht in ihrer Lage verriegeln kann.

5. Intramedulläre intertrochantäre Frakturfixationsvorrichtung nach einem beliebigen der vorangehenden Ansprüche 1 bis 4 in Kombination mit einer abnehmbaren Einpaßvorrichtung (13) dafür, welche eine Fixierungseinrichtung (12,27,28) aufweist, um die besagte Vorrichtung (13) auf dem proximalen Ende des besagten Stabs (1) durch Eingriff mit der besagten Befestigungseinrichtung (11) bestimmt zu fixieren, dadurch gekennzeichnet, daß die besagte Fixiereinrichtung (12,27,28) Zugangseinrichtungen (31) zur Betätigung der besagten Anit-Dreheinrichtung (4,7) bei auf dem besagten Stab (1) bestimmt fixierter Einpaßvorrichtung (13) aufweist.

6. Intramedulläre intertrochantäre Frakturfixationsvorrichtung und Einpaßvorrichtung nach Anspruch 5, dadurch gekennzeichnet, daß die besagten Zugangseinrichtungen (31) durch Zugangsöffnungseinrichtungen (31) bereitgestellt werden, durch welche die besagte Anti-Dreheinrichtung (4,7) betätigt werden kann, wenn sich die Einpaßvorrichtung (13) in ihrer Lage auf dem Stab (1) befindet.

7. Intramedulläre intertrochantäre Frakturfixationsvorrichtung und Einpaßvorrichtung nach Anspruch 6, dadurch gekennzeichnet, daß die besagte Fixiereinrichtung (12,27,28) eine Befestigungsschraube (28) einschließt, die in einen mit einem Gewinde versehenen Teil (11) der koaxialen Bohrung (3,10) eingreift, um die Einpaßvorrichtung (13) in ihrer Lage auf dem besagten Stab (1) festzuklemmen, wobei die besagte Befestigungsschraube (28) Zugangsöffnungseinrichtungen (31) in Form einer Bohrung (31) aufweist, durch welche die Anti-Dreheinrichtung (4,7) in der koaxialen Bohrung (3,10) im Stab (1) betätigt werden kann.

8. Intramedulläre intertrochantäre Frakturfixationsvorrichtung und Einpaßvorrichtung nach Anspruch 6 oder Anspruch 7, dadurch gekennzeichnet, daß die besagte Anti-Dreheinrichtung (4,7) eine Stellschraube (4) einschließt, und die Zugangsöffungseinrichtungen (31) so bemessen sind, daß sie ein Einführen der Stellschraube (4) durch sie hindurch in die koaxiale Bohrung (3) gestatten.

9. Intramedulläre intertrochantäre Frakturfixationsvorrichtung und Einpaßvorrichtung nach einem beleibigen der vorangehenden Ansprüche 5 bis 8, gekennzeichnet durch Führungseinrichtungen (36,40), um eine Einrichtung zwecks Bildung eines Lochs im Femurkopf zur Aufnahme der besagten Schenkelhalsschraube (5) genau zu führen.

10. Intramedulläre intertrochantäre Frakturfixationsvorrichtung und Einpaßvorrichtung nach Anspruch 9, dadurch gekennzeichnet, daß die besagten Führungseinrichtungen (36,40) eine Tunnelfixierung (40) einschließen.

11. Intramedulläre intertrochantäre Frakturfixationsvorrichtung und Einpaßvorrichtung nach Anspruch 10, dadurch gekennzeichnet, daß ein Ende (42) der besagten Tunnelfixierung (40) für einen Eingriff und eine Fixierung auf dem intramedullären Stab (1) angepaßt ist.

12. Intramedulläre intertrochantäre Frakturfixationsvorrichtung und Einpaßvorrichtung nach Anspruch 10 oder Anspruch 11, dadurch gekennzeichnet, daß die besagte Einpaßvorrichtung eine abnehmbare Zugkrafteinstellvorrichtung (50) einschließt, die sich zum Verbinden mit dem proximalen Ende der Halsschraube (5) durch die besagte Tunnelfixierung (40) erstreckt und Einstelleinrichtungen (56) aufweist, um eine Zugkraft auf die besagte Schraube (5) aufzubringen.

13. Intramedulläre intertrochantäre Frakturfixationsvorrichtung und Einpaßvorrichtung nach Anspruch 12, dadurch gekennzeichnet, daß die besagten Einstelleinrichtungen (55,56) mit dem proximalen Ende der Tunnelfixierung (40) in Eingriff treten, um zwischen den besagten Einstelleinrichtungen (55,56) und dem intramedullären Stab (1) eine Druckkraft darauf aufzubringen.

14. Intramedulläre intertrochantäre Frakturfixationsvorrichtung und Einpaßvorrichtung nach Anspruch 13, dadurch gekennzeichnet, daß die besagte abnehmbare Zugkrafteinstellvorrichtung (50) Einrichtungen (53) aufweist, um mit Antriebseinrichtungen (20) auf der Halsschraube (5) in Eingriff zu treten, um sie in Position zu bringen.

15. Intramedulläre intertrochantäre Frakturfixationsvorrichtung und Einpaßvorrichtung nach Anspruch 14, dadurch gekennzeichnet, daß die besagte Zugkrafteinstellvorrichtung (50) einen Schraubendreher mit einem hohlen Schaft (52) umfaßt, wobei das distale Ende des besagten Schaftes (52) Einrichtungen (53) aufweist, um mit der Halsschraube (51) in Eingriff zu treten, um sie in Position zu bringen, sowie mit einem Betätigungsgriff (51), wobei sich eine Spannungseinstellvorrichtung (56) in axialer Richtung durch den besagten hohlen Schaft (52) erstreckt, wobei ein Ende der besagten Einstellvorrichtung mit einem Schraubgewinde (57) versehen ist, um mit einer Gewindebohrung (21) im Ende der Halsschraube (5) in Eingriff zu treten, und wobei das andere Ende einen Betätigungsteil (51) aufweist, mittels dessen es gedreht werden kann, wobei der hohle Schaft (52) eine mit einem Schraubgewinde versehene Einstellvorrichtung (55) trägt, die gegen das proximale Ende der Tunnelfixierung (41) wirken kann.

16. Intramedulläre intertrochantäre Frakturfixationsvorrichtung und Einpaßvorrichtung nach einem beliebigen der vorangehenden Ansprüche 5 bis 15, bei welcher die besagte abnehmbare Einpaßvorrichtung mit Einrichtungen (45,46) versehen ist, um eine Einrichtung zwecks Bildung eines Lochs oder von Löchern im Femur zur Aufnahme von Schrauben oder Bolzen zur Fixierung des distalen Endes des intramedullären Stabs (1) zu führen.

Revendications

1. Instrument intramédullaire pour l'ostéosynthèse intertrochantérienne pour une utilisation avec un dispositif de mise en place amovible (13), et qui comprend une tige intramédullaire (1) ayant des extrémités proximale et distale, et ayant une ouverture inclinée (2) pour recevoir une vis à col (5) pour fémur, [adite tige (1) ayant un alésage coaxial (3, 10) pénétrant à l'intérieur de ladite ouverture inclinée (2); des moyens anti-rotation (4, 7) situés dans ledit alésage coaxial (3, 10) qui peuvent être actionnés pour empêcher la rotation de ladite vis à col (5) dans ladite ouverture inclinée (2), l'extrémité proximale dudit alésage coaxial (3, 10) étant pourvu de moyens de fixation (11) pour recevoir ledit dispositif de mise en place amovible (13) ; caractérisé en ce que lesdits moyens de fixation (11) sont indépendants et séparés desdits moyens anti-rotation (4, 7), et peuvent être utilisés pour recevoir, maintenir rigidement et positionner ledit dispositif de mise en place amovible (13), indépendamment de l'actionnement desdits moyens anti-rotation (4, 7).

2. Instrument intramédullaire pour l'ostéosynthèse intertrochantérienne selon la revendication 1, caractérisé en ce que lesdits moyens de fixation (11) sont constitués par une partie filetée agrandie (11) dudit alésage coaxial (10).

3. Instrument intramédullaire pour l'ostéosynthèse intertrochantérienne selon la revendication 1 et la revendication 2, dans lequel lesdits moyens anti-rotation (4, 7) comportent des rainures (7)

pratiquées sur ladite vis à col (5), avec lesquelles peut venir en prise une vis de réglage (4) située dans ledit alésage (3, 10), pour empêcher la rotation de la vis à col (5) tout en permettant le glissement de celle-ci ou son blocage en position.

4. Instrument intramédullaire pour l'ostéosynthèse intertrochantérienne selon la revendication 3, caractérisé en ce qu'il comporte deux vis de réglage (4), mais de dimensions différentes pour une utilisation alternée dans la tige intramédullaire (1), une vis (4) étant de configuration sensiblement plane, et l'autre ayant un rebord (73) qui peut coopérer avec un moyen de butée sur la tige intramédullaire (1) pour situer sa position axiale, de telle manière qu'elle puisse pénétrer dans les rainures (7) dans la vis à col (5), mais non la bloquer en position.

5. Instrument intramédullaire pour l'ostéosynthèse intertrochantérienne selon l'une quelconque des revendications 1 à 4, en combinaison, avec un dispositif de mise en place amovible (13), qui a des moyens de positionnement (12, 27, 28) pour positionner de façon rigide ledit dispositif (13) sur l'extrémité proximale de ladite tige (1) en engageant lesdits moyens de fixation (11), caractérisés en ce que lesdits moyens de positionnement (12, 27, 28) ont des moyens d'accès (31) pour l'actionnement desdits moyens anti-rotation (4, 7) avec le dispositif de mise en place (13) positionné rigidement sur ladite tige (1).

6. Instrument intramédullaire pour l'ostéosynthèse intertrochantérienne et dispositif de mise en place selon la revendication 5, caractérisés en ce que lesdits moyen d'accès (31) sont pourvus d'un moyen d'ouverture d'accès (31), à travers lequel lesdits moyens anti-rotation (4, 7) peuvent être actionnés quand le dispositif de mise en place (13) est en position sur la tige (1).

7. Instrument intramédullaire pour l'ostéosynthèse intertrochantérienne et dispositif de mise en place selon la revendication 6, caractérisés en ce que lesdits moyens de positionnement (12, 27, 28) comportent un boulon (28) de fixation qui coopère avec une partie filetée (11) de l'alésage coaxial (3, 10) pour bloquer le dispositif de mise en place (13) en position sur ladite tige (1), ledit boulon (28) de fixation ayant des moyens d'ouverture d'accès (31) sous la forme d'un alésage (31), à travers lequel les moyens antirotation (4, 7), dans l'alésage coaxial (3, 10) dans la tige (1), peuvent être actionnés.

8. Instrument intramédullaire pour l'ostéosynthèse intertrochantérienne et dispositif de mise en place selon la revendication 6 ou la revendication 7, caractérisés en ce que lesdits moyens anti-rotation (4, 7) comportent une vis (4) de réglage, et en ce que les moyens d'ouverture d'accès (31) sont dimensionnés pour permettre à la vis (4) de réglage d'être insérée à travers, à l'intérieur de l'alésage coaxial (3).

9. Instrument intramédullaire pour l'ostéosynthèse intertrochantérienne et dispositif de mise en place selon l'une quelconque des revendications précédentes 5 à 8, caractérisés par des moyens de guidage (36, 40) pour guider de façon précise le moyen pour former un trou dans la tête d'extrémité du fémur, afin de recevoir ladite vis à col (5) pour le fémur.

10. Instrument intramédullaire pour l'ostéosynthèse intertrochantérienne et dispositif de mise en place selon la revendication 9, caractérisés en ce que lesdits moyens de guidage (36, 40) comportent une pièce de positionnement (40) en forme de tunnel.

11. Instrument intramédullaire pour l'ostéosynthèse intertrochantérienne et dispositif de mise en place selon la revendication 10, caractérisés en ce qu'une extrémité (42) de ladite pièce de positionnement (40) en forme de tunnel est adaptée pour s'engager et se positionner sur la tige intramédullaire (1).

12. Instrument intramédullaire pour l'ostéosynthèse intertrochantérienne et dispositif de mise en place selon la revendication 10 ou la revendication 11, caractérisés en ce que ledit dispositif de mise en place comporte un organe démontable (50) de réglage de tension, qui s'étend à travers ladite pièce de positionnement (40) en forme de tunnel pour sa connexion à l'extrémité proximale de la vis à col (5), et a des moyens d'ajustement (56) pour appliquer une tension à ladite vis (5).

13. Instrument intramédullaire pour l'ostéosynthèse intertrochantérienne et dispositif de mise en place selon la revendication 12, caractérisés en ce que lesdits moyens d'ajustement (55, 56) coopèrent avec l'extrémité proximale de la pièce de positionnement (40) en forme de tunnel, pour appliquer une compression sur elle, entre lesdits moyens d'ajustement (55, 56) et la tige intramédullaire (1).

14. Instrument intramédullaire pour l'ostéosynthèse intertrochantérienne et dispositif de mise en place selon la revendication 13, caractérisés en ce que ledit organe démontable (50) de réglage de tension a un moyen (53) pour coopérer avec le moyen de poussée (20) sur la vis à col (5) pour la pousser en position.

15. Instrument intramédullaire pour l'ostéosynthèse intertrochantérienne et dispositif de mise en place selon la revendication 14, caractérisés en ce que ledit organe démontable de réglage (50) de tension comprend un pousseur de vis avec un arbre creux (52), l'extrémité distale dudit arbre (52) ayant un moyen (53) pour coopérer avec la vis à col (5), afin de la pousser en position, et un manche opératoire (51), un organe de réglage (56) de tension s'étendant axialement à travers ledit arbre creux (52), une extrémité (57) dudit organe de réglage étant filetée pour coopérer avec un alésage fileté (21) dans l'extrémité de la vis à col (5), et l'autre extrémité ayant une partie opératoire (51) par laquelle il peut tourner, l'arbre creux (52) portant un organe fileté de réglage (55) qui peut agir contre l'extrémité proximale de la pièce de positionnement (41) en forme de tunnel.

16. Instrument intramédullaire pour l'ostéosynthèse intertrochantérienne et dispositif de mise en place selon l'une quelconque des revendications précédentes 5 à 15, dans lesquels ledit dispositif de mise en place amovible est pourvu de moyens (45, 46) pour guider un moyen afin de former un trou ou des trous dans le fémur, pour recevoir des vis ou des chevilles, afin de positionner l'extrémité distale de la tige intramédullaire.

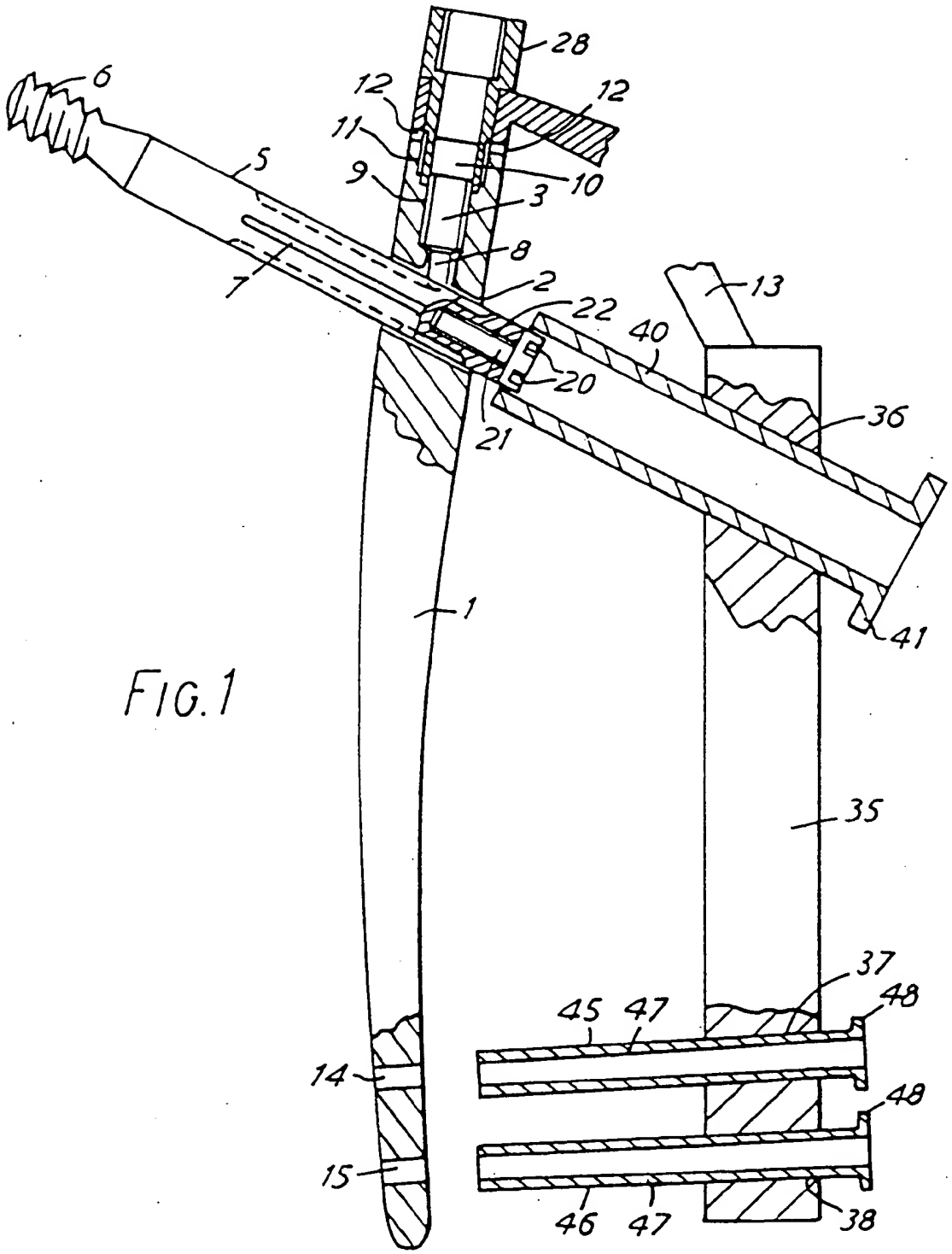
28
6
12
12
11
5
9
10
3
8
7
2
22
13
40
20
36
21
1
41
35
37
48
45
47
14
48
15
46
47
38

FIG. 1

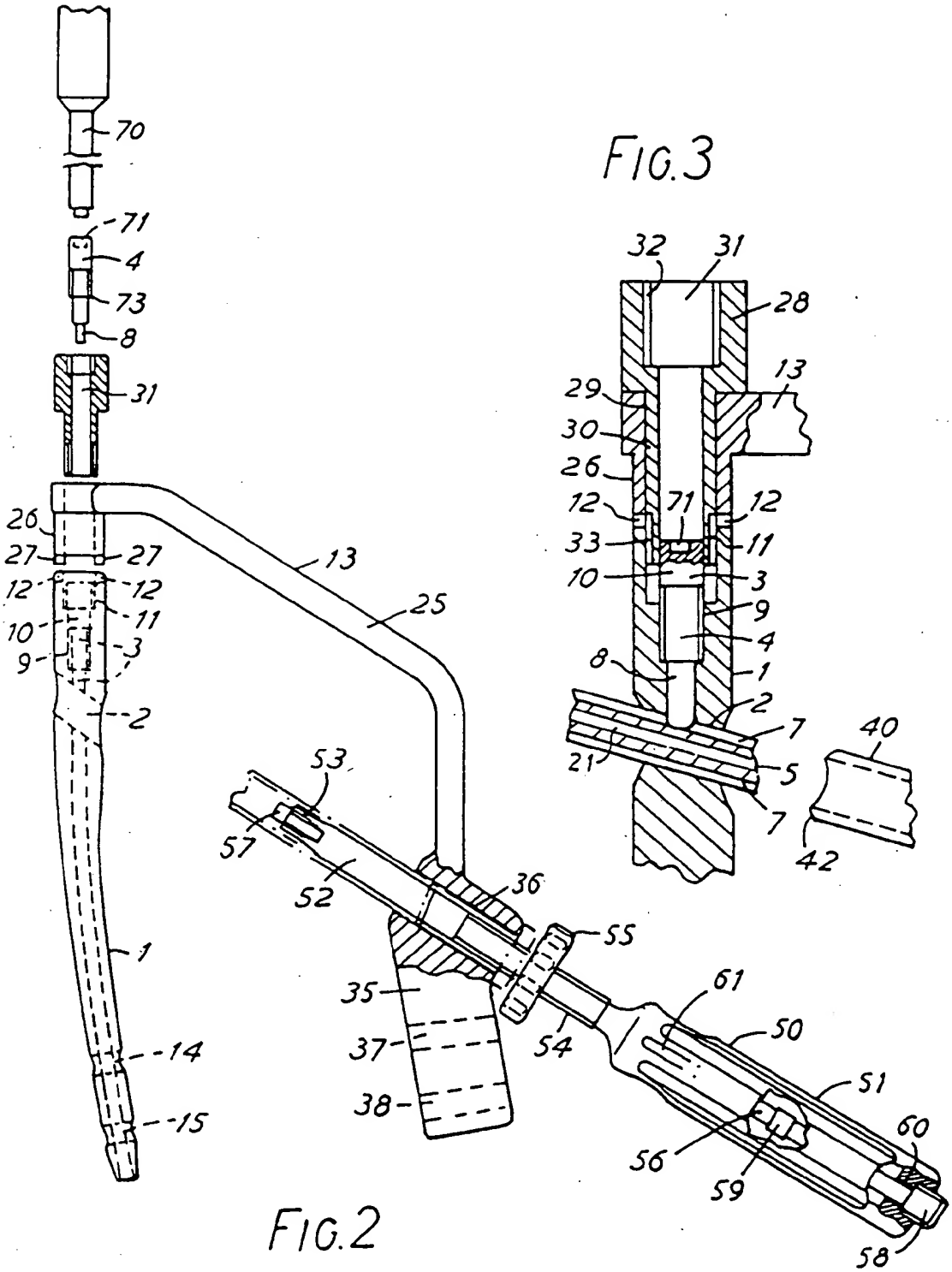
70
71
4
73
8
31
26
27
27
12
12
11
10
3
9
2
13
25
1
14
15
53
57
52
36
55
35
37
38
54
61
50
51
60
56
59
58

FIG.2

FIG.3

32
31
28
13
29
30
26
12
71
12
33
11
10
3
9
4
8
1
2
7
40
21
5
7
42

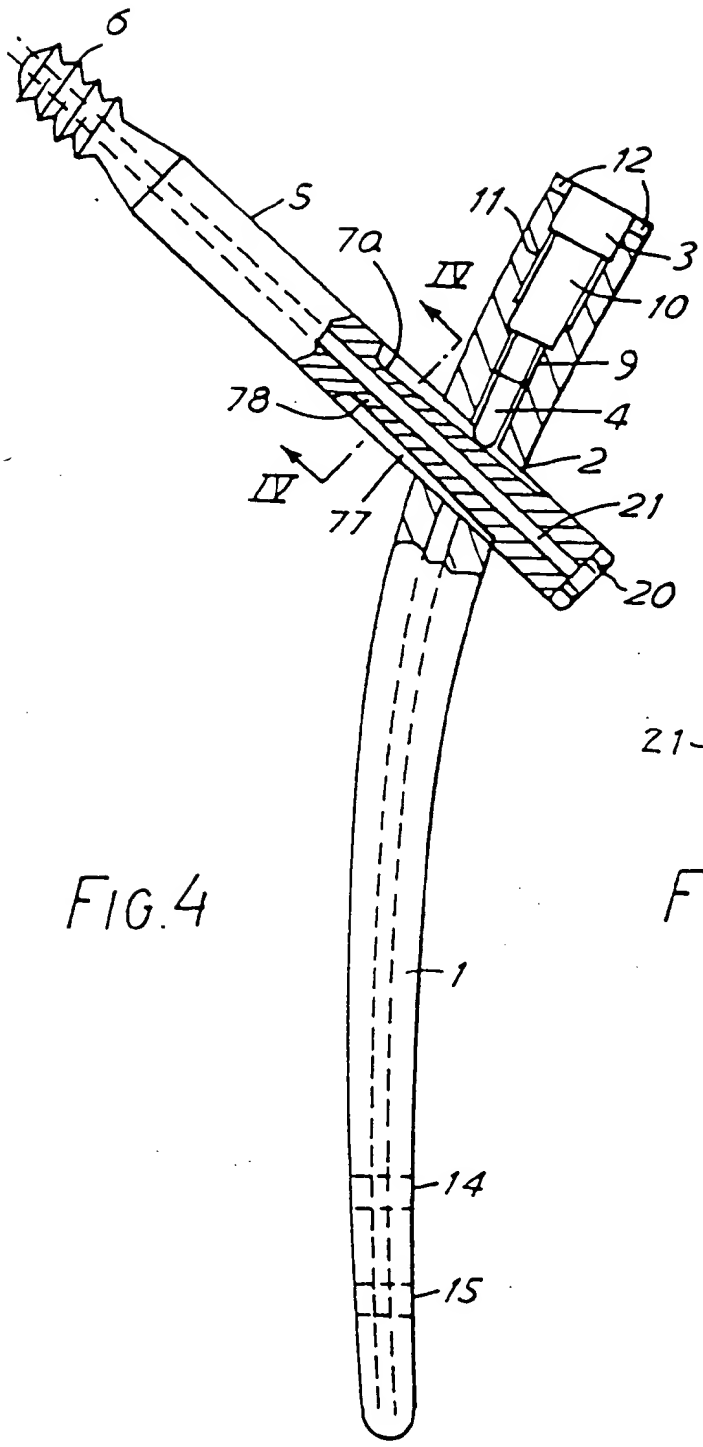

FIG.4

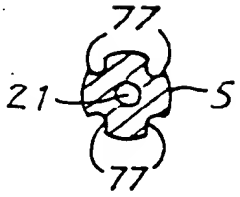

FIG.5